Particle Motion HW Key:

① $s(t) = t^3 - 12t^2 + 36t, \quad t \geq 0$

a) $v(t) = 3t^2 - 24t + 36$

b) $v(3) = -9$ m/sec

c) $v(t) = 0 = 3t^2 - 24t + 36$

$0 = 3(t^2 - 8t + 12)$

$0 = 3(t-6)(t-2)$

$t = 6$ sec

$t = 2$ sec

d) $v(t)$

forward when $v(t)$ is pos

$(0,2) \cup (6,\infty)$

e)

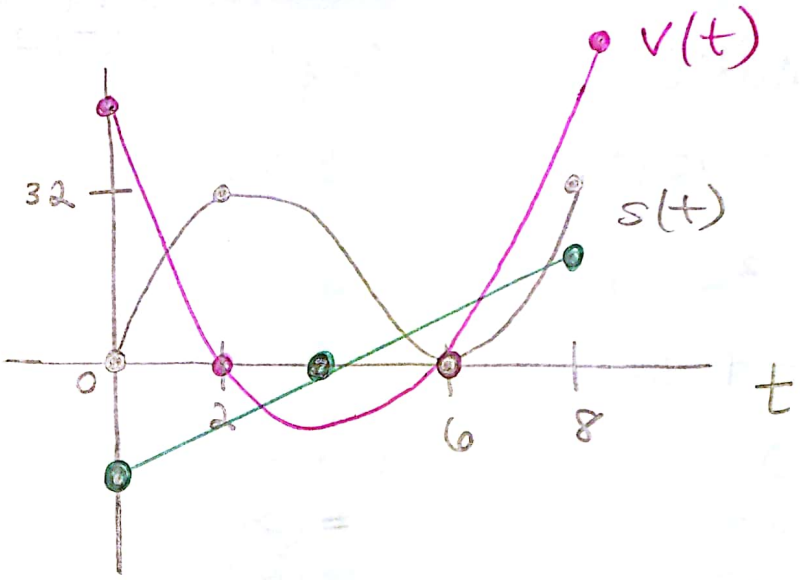
t	$s(t)$	
0	0	> 32
2	32	> 32
6	0	> 32
8	32	

displacement: $32 - 0 = 32$ m

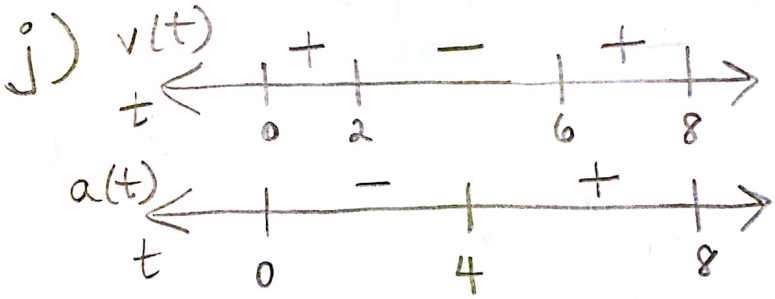
f) $32 + 32 + 32 = 96$ m = total distance

h) $a(t) = 6t - 24$

i)



j)



$a(t) = 6t - 24$

$0 = 6t - 24$

$t = 4$

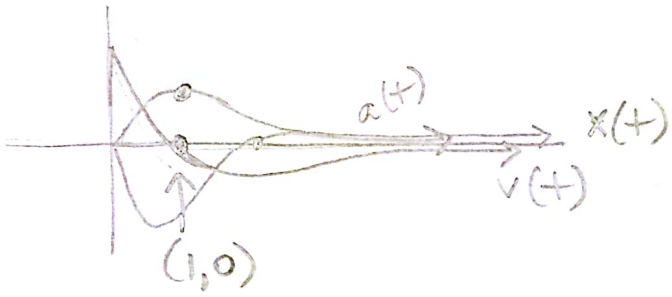
Speeding up: $(2,4) \cup (6,8)$

slowing down: $(0,2) \cup (4,6)$

* calc active

(2) $x(t) = \frac{t}{1+t^2}$, $t \geq 0$

a)



b) right $v(t)$ is pos $(0,1)$
left $v(t)$ is neg $(1,\infty)$

c) $x(4) - x(0) = \frac{4}{17} - 0 = \frac{4}{17}$ meters
(.235)

d)

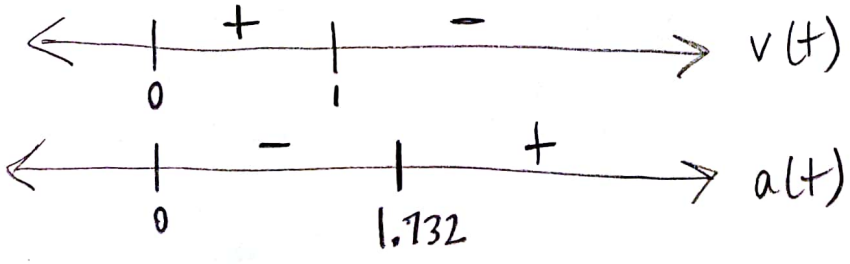
t	$x(t)$
0	0
1	1/2
4	4/17

$> \frac{1}{2}$ $> \frac{9}{34}$ $+ = \frac{13}{17}$ meters (.765)

e) $a(t) = 0$ at $t = 1.732$ sec

f) see above

g) speed up: $(1, 1.732)$
slow down: $(0,1) \cup (1,\infty)$



~ ③ $y(t) = t^3 - 12t + 3, \quad t \geq 0$

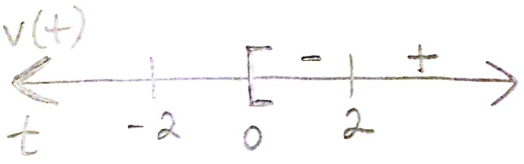
a) $v(t) = 3t^2 - 12$

$a(t) = 6t$

b) $v(t) = 0 = 3t^2 - 12$

$0 = 3(t^2 - 4)$

$t = 2, \cancel{-2}$



up: when $v(t)$ is pos $(2, \infty)$

down: when $v(t)$ is neg $(0, 2)$

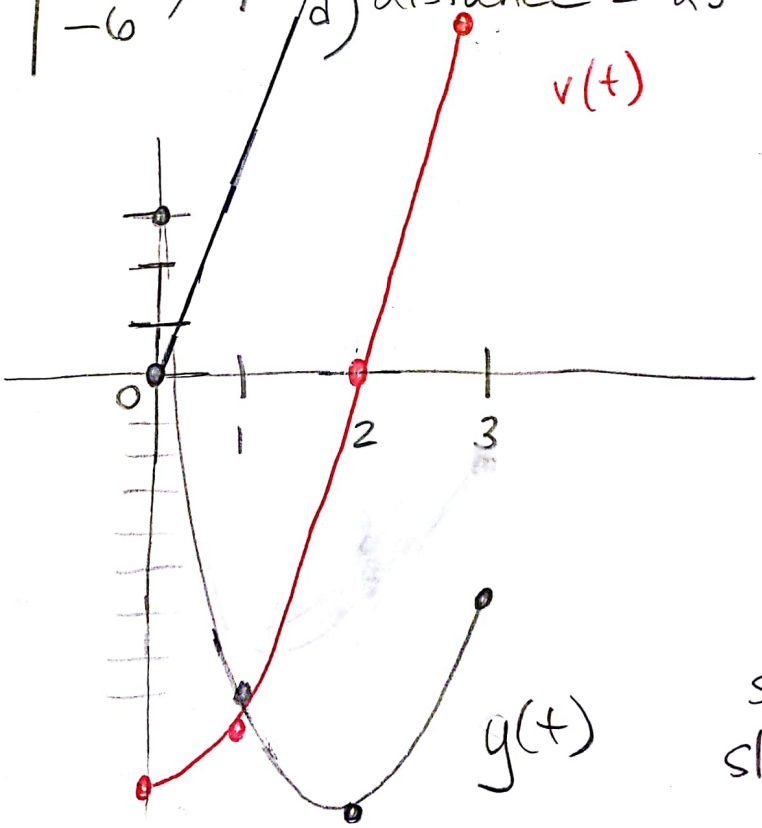
c)

t	$y(t)$	
0	3	> 16
2	-13	> 7
3	-6	

displacement = $-6 - 3 = -9$

d) distance = 23

e)



$y(0) = 3$

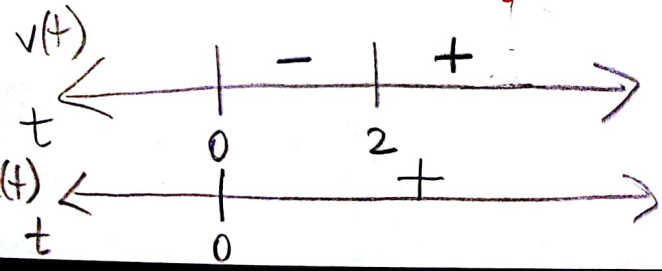
$y(1) = -8$

$y(2) = -13$

$y(3) = -6$

speed up: $(2, \infty)$

slow down: $(0, 2)$



$a(t) = 0 = 6t$

$t = 0$